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FOR THE COMMANDER

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Adequate Planning for Acquiring Sufficient Documentation about and Rights in Software to Permit Organic or Competitive Maintenance

Pamela Samuelson

Abstract. Both the DoD and industry have significant concerns regarding maintenance and enhancement of software. The DoD wants to be certain it will be able to maintain and enhance software, and where cost effective, to compete maintenance of software. Industry wants ensure that its proprietary interests will be adequately protected. This paper will explore possible ways in which both groups' interests might be satisfied.

Introduction

The Department of Defense (DoD) is a major consumer of software. This software is used as a vital component of many systems ranging from those which perform relatively simple functions, such as intra-office communications and word processing, to sophisticated software which is embedded in major weapons and defense systems. The procurement of software is an ongoing rather than discrete event. This is because software must be maintained, and, as needs change, enhanced.

Maintenance and enhancement of software is often a problematic and expensive undertaking. As a result of issues arising under the copyright laws and DoD acquisition regulations, as well as other practical problems, the DoD quite often finds that it does not possess adequate documentation, software tools, and/or intellectual property rights to perform necessary maintenance and enhancement functions, either organically or through competitive reprocurement. As a result, the DoD may be left in the position of having to return to the original contractor whose possession of needed documentation and/or rights puts the contractor in a sole source position as to DoD maintenance and enhancement needs. This, of course, is a position DoD would prefer to avoid, for both economic and political reasons.

This paper explores the legal, regulatory and logistical problems related to software maintenance and enhancement. Some potential solutions for acquiring sufficient documentation and intellectual property rights to allow for organic and/or competitive reprocurement for maintenance and enhancement are offered.

A. The Hybrid Character of Software

To begin, it is important to understand the hybrid nature of software. Software in its machine-readable form has some characteristics of hardware and some characteristics of technical data. This hybrid character has made it difficult to categorize exactly how software should be acquired, and then maintained after acquisition: should it be treated like hardware or like technical data, or as a distinct item altogether? This section is intended to explore ways in which this hybrid character may affect planning for software maintenance and enhancement.

1. Software/Hardware

Software is like hardware in that it causes machines to do things. Software is in fact merely a replacement for hardware components that could otherwise perform the same function. Software is often embedded in hardware and part of an overall hardware system. Like hardware, software can often serve as a tool for creating other items, including new software. And like hardware, software will require maintenance work from time to time to operate properly, although the type of maintenance which software requires, such as fixing a "bug" or making an enhancement, differs in many respects from the more traditional forms of maintenance required by hardware.

Software is unlike hardware, however, in many other ways. Software is, for example, less difficult and less expensive to replicate than is hardware. Once the first copy has been produced, software can be almost endlessly replicated at little cost regardless of how complex the code is. One of the consequences of this is that the government tends to think that additional copies of software ought to be deliverable at a very low cost, whereas industry, which is concerned about recouping its research and development costs, regards additional sales at higher price levels to be necessary to make the software industry viable. Because of the ease of replication, industry representatives often regard the sale of software as more akin to the sale of a production facility rather than the sale of a single product (as if one bought a General Motors factory when one bought a truck produced by GM). Another consequence of this low-cost replicability is that the software industry, for the most part, tends to make its products available only on a highly restrictive licensing basis, rather than selling copies outright.

Another important difference between software and hardware is that software may be subject to a very lengthy lawful monopoly period (i.e., the approximately 75 year period of a copyright) as well as being held as a trade secret, whereas hardware is likely to be subject to a much shorter monopoly (i.e., the seventeen year period of a patent) and most often cannot be held as a trade secret since reverse engineering of the hardware would likely reveal any "secrets" contained therein. Quite often, in fact, hardware is either not patented at all or only subject to partial patent protection. Patents are usually difficult to get because of the high standards of invention that must be met, whereas copyrights are relatively easy to obtain. Hardware, unlike software, cannot be copyrighted at all. Moreover, software, if copyrighted, will also be subject to strict limitations on the rights of the user to make derivative works from the software. Hardware, even if patented, is not subject to similar limitations.

The main point here is that because of the great breadth and length of the copyright monopoly on software, it will be much harder to get competition as to software reprocurements and maintenance than as to hardware. A consequence of this is that it is even easier to get "locked into" a sole source position as to software than as to hardware. Because the government is becoming ever more dependent on software, this should be a serious concern.

Also, because software engineering is a discipline which is still in the early stages of its development, it is generally more difficult to specify how software should be developed for particular functions and to estimate the costs and development schedule for it. Software is also virtually

"invisible" as compared with hardware, which means that it is more difficult to detect if someone delivers very similar or nearly identical software on a second development contract. Further "invisibility" means that it may be more difficult, as a general matter, to detect defects in software or to know how to fix them once the defect is known. Again, because software engineering is a developing art, software is likely to contain a lot of undetected defects that will need to be corrected while in the user's possession. Also, unlike hardware, software is, in general, readily changeable; new capabilities can be added without substantial additional costs. All of this tends to make software maintenance and enhancement a much more substantial part of software life cycle planning than may be the case with hardware.

2. Software/Technical Data

Software and technical data are similar in that both are recorded information. They are also alike in that both are often held as trade secrets, and licensed under restrictive conditions, rather than being sold in the marketplace. Loss of the secrets may undermine or destroy the firm's commercial advantage. Both are also capable of being claimed as unpublished copyright material. Both involve modest production costs in themselves once the technology they embody has been developed. Both are difficult to price with any precision.

Because the material costs are low (i.e, what it costs to do a drawing on paper, what it costs to make a second copy of software), the government often thinks the price ought to be low. Because it is the valuable technology that they embody that the firm wants to protect and exploit, industry tends to price them high. With both software and technical data, crucial information necessary for maintenance or enhancement of the item to which they pertain may not be readily apparent from examination of the paper or disk; rather it may be stored away in the memory of some engineer who designed it. Ongoing service contracts are sometimes necessary to be able to gain access to that type of expertise.

Where software differs from technical data is in being an "end item" in itself. Software is a product that will perform machine functions, whereas technical data is merely information about a product. As an end item, software will be more likely to be a product with a commercial market whereas technical data will often not be sold or licensed to anyone but the government. When altered, software will perform differently, as compared with technical data which will simply reflect a new configuration. Software also requires an environment of equipment and other software to be effective.

B. Getting Adequate Rights and Documentation to Maintain and Enhance Software

The DoD has been experiencing some difficulty in acquiring sufficient rights in software and software documentation to enable it to maintain or enhance software, either in-house (commonly referred to as "organic maintenance") or by private firms through competitive bidding. This section discusses some of the reasons underlying these difficulties.

1. Getting Rights to Modify

In contrast to the beliefs of many who have addressed DoD's software procurement problems, the acquisition of the rights necessary to modify software is not a current software licensing problem of the Defense Department. While many other buyers or licensees of software are experiencing difficulty in negotiating with software firms about whether or not they or persons whom they authorize can modify software, this does not seem to be DoD's problem. The DoD procurement regulations require that in all software acquisition contracts the government must get the right to modify the software.[1] Government lawyers, on the whole, tend to think that this means that even when a contract between the government and a software contractor is silent about modification rights, the standard data rights clause will be construed by a court to be incorporated into the contract under the Christian doctrine.[2] On the other hand, though, some DoD personnel seem to believe that if prime contractors negotiate away the government's right to modify software in dealing with a subcontractor, the government would be bound by the prime's action. This may not in fact be so, although the law is uncertain in this area.

If, instead of relying on the DoD standard data rights clause, the government were to rely on the copyright law as a basis for obtaining rights to modify software, the government might have some serious difficulties. Copyright law regards a modification of copyrighted software as the creation of a "derivative work" for which one would need the permission of the copyright owner.[3] Although there is a limited right to modify software under Section 117 of the copyright law, the right is so limited as to be virtually nonexistent (1) because only "owners" of copies (and not licensees) have such rights, and (2) because modifications are only permitted to the extent they are created as an "essential step in the utilization of a computer program in conjunction with a machine." One court has interpreted this to mean that modifications are only permitted if the program won't execute as is.[4] Because copyright law currently offers such limited rights to modify software, it is important that DoD has made modification rights part of the package of minimum rights that it always gets in software.

2. Getting Adequate Documentation To Make Modifications

Getting adequate software documentation seems to be the major software maintenance/enhancement problem the Defense Department is currently having. Many of DoD's difficulties seem to fall within one of the following categories of problems:

(a) companies being unwilling to give their source code or other proprietary information to the government at any price or under any conditions;

(b) the need to be farsighted enough to ask for delivery of all the documentation needed to enhance or maintain a system;

(c) the need to supervise the delivery of documentation to insure that everything was delivered that should have been delivered;

(d) the need to supervise the attachment of restrictive notices to software; or

(e) difficulty in comprehending the documentation delivered because of its complexity or turgidity.

There seems to be general agreement among DoD personnel that steps need to be taken to remedy this situation. Some are hopeful that solutions can be devised that would create greater incentives for industry to voluntarily cooperate with DoD in its efforts to get better documentation for maintenance purposes. Some worry that punitive approaches could enhance already strong disincentives to cooperate with the government in this respect. The possibility of the government entering escrowing agreements whereby needed documentation is placed into escrow with the government to have access to the documentation on an as needed basis upon the meeting of some certain specified condition(s) precedent is a potential solution which holds significant promise. Such arrangements have been used with a large amount of acceptance and success within private industry.

3. Getting Sufficient Rights In Software And Documentation To Get Competition As To Software Maintenance And Enhancements

Whether the government can get competition in software maintenance and enhancement contracts seems largely to turn on whether the government has ownership of or unlimited rights in software and its associated documentation, or whether the government has only restricted rights as to the software and limited rights as to the documentation. If the government has ownership or unlimited rights, getting competition in software maintenance/enhancement contracts appears to be relatively easy. If instead the government has only restricted and limited rights, it seems that getting competition is very difficult. Defense Department personnel generally report little success in getting restricted rights software competitively maintained.

As the DoD regulations are presently written, while DoD virtually always has rights to modify software, it does not automatically have rights to sublicense the modification right to others. That means that getting competition as to maintenance and enhancement of restricted rights software will only be feasible if the software's owner will agree, which he need not. If he will not agree, DoD will either have to do the modifications itself or hire the original firm to do the maintenance on a sole source basis.

Because many software companies may wish to have sole source maintenance contracts with DoD, their incentives to agree to competitive maintenance arrangements are minimal. It seems that the best, and perhaps only time there may be any opportunity to get such agreements to allow competitive maintenance is during the original competition when the development contract is let. For this reason, it seems imperative that DoD personnel involved in software acquisition be as well trained and prepared as possible to recognize DoD's maintenance and enhancement needs so as to increase the probability that they will be able to secure favorable arrangements at this time when DoD's leverage is at its peak.

C. Maintenance Needs For Things Used In Performance of Government Contracts: Software Tools and CAD/CAM Programs

Documentation is often not the only thing needed in order to maintain or enhance software. Access to software tools and/or CAD/CAM programs may also be needed to do maintenance and enhancement work. Indeed, because of the tremendous commercial value of software tools and CAD/CAM programs, as well as the usually steep development costs, it may be even more difficult to persuade industry to make these valuable items available to the government than it would be to persuade them to part with software documentation. In addition, industry may be particularly sensitive about government proposals to license competitors to make use of these valuable technologies since these items will often be a part of the companies' competitive edge in the market place.

1. Software Tools

Software tools are a set of programs that may be used in the production of other programs. Software tools commonly include editors, compilers, and debuggers, among other things. The application software produced by the tools could be anything from the guidance system of a missile to an inventory control program. Much of the expensive software the government buys is software which is expected to be modified over time. For example, satellite monitoring systems must be revised whenever a new satellite is launched. In order to modify application software in an optimal way --and in some cases, in order to modify it at all -- it may be desirable or necessary to have access to the software tools that were used to create the program in the first place.

Even if the government's procurement personnel have the foresight to try to bargain to obtain rights in software tools, the company may be extremely reluctant to grant anyone -- let alone the government (which is widely perceived by industry to be unable to protect commercial secrets) -- to have a copy of the software tools, or even to have access to the tools. A software producer's tools may be perceived to be <u>the</u> major factor in the company's competitive edge in the industry. In addition, the development of such tools often requires a substantial inventment on the part of the company, an investment which the company, understandably, expects to be able to recoup. Consequently, making such items available to the government is often a highly charged subject. Indeed, for the government to be able to make any deal to get proprietary software tools is offen thought a remarkable event.

One potential approach to this problem, as was also mentioned in the discussion regarding documentation above, would be for the government to enter into an escrow agreement with the developer. An escrow arrangement could be structured so as to allow the government access to needed tools and other programs, upon the meeting of some specified condition(s) precedent, while still protecting the company's proprietary information. Moreover, such an approach would be consistent with normal commercial practices.

Another potential approach to this problem would be for non-governmental third parties to enter into licensing arrangements with the software tool producer (assuming that the company would

license anyone) on more restrictive terms than government procurement practices would allow. The government could then allow this third party licensee to do the maintenance/enhancement work. This may not be a viable solution in some instances, however, since there seems to be a strong preference, if not a clear policy, for DoD to do "organic" maintenance/enhancement work for all weapons system software and weapons related software. It also seems that many companies would not license proprietary software tools to anyone. In these cases, however, the escrow approach might still be available.

Further, it should be noted that those software tools which are made available to the government or to third party maintainers are likely to be "older", less valuable technologies. The government may often have to be content to use such older technologies if it wants to have unlimited rights in software tools. If DoD's priority is to get the best technology, using old tools doesn't seem to be desirable. If DoD's priority is to be able to do all maintenance and enhancement organically, then having rights to old tools is better than having rights in none.

2. CAD/CAM Programs

Increasingly, industries are using computer aided design/computer aided manufacturing (CAD/CAM) programs to design systems of many sorts, as well as to manufacture them. This seems to be especially true with regard to the aircraft industry. Because aircraft tend to be rather expensive systems and systems which require more than a modest amount of maintenance and enhancement, both as to software and hardware components, there is growing concern within the Defense Department about getting access to and rights in the CAD/CAM programs used to design the systems initially. Access to these programs may be essential to do maintenance and enhancement work for the system. The companies that have developed them may be unwilling or at least very reluctant to give the government any rights to them, or to authorize third party maintainers to have access to them because of their great commercial value, and high development costs. This, therefore, is another area where use of escrowing agreements might prove a useful way for the government to gain access to the technology necessary to fulfill its maintenance and enhancement requirements. Arrangements providing for access to such tools, rather than actual physical possession of them, are often more acceptable to industry.

D. Other Problems With Getting Delivery of Adequately Supportable Systems

1. Different Interests Of Buyers and Maintainers Within the Government

There also appears to be some structural problems internal to the Defense Department that may make adequate planning for software maintenance and enhancement difficult to achieve. Major weapons or communication systems acquired by DoD may include complex software components. These systems may also require significant and complex software systems to support the major systems. If the command which purchases the system is not the command which will

use, maintain, or enhance the system, it may not be aware of the extent of software documentation that will be needed to use, enhance, or maintain the software, and it may not be as sensitive to the need for supportability of the software as the using or maintaining command might need it to be. Although there are some structural mechanisms within DoD that are intended to provide opportunities for communication about such matters, that may not always work as successfully as DoD would wish. This could be a contributing cause toward the software maintenance and enhancement problems DoD has encountered.

2. Sole Source Maintenance As a Habit

From procurement personnel's point of view, if a company has built a complex piece of software for DoD, and it's a good piece of software, that company will likely know that software better and will be able to maintain it better than any other company, even if the other company gets the source code. That software engineering is still in fairly primitive stages as an engineering discipline makes reliance on the original developer to do maintenance work often seem the most expedient route to take. The developing company will have a better idea of how to avoid the problems that enhancing one section of a program can so often create in another part of code. Theoretically, the developing firm will be able to do the job faster, more reliably, and more cheaply than a competitor because they won't have to be brought up to speed on it, and if it's a good piece of code, then the developing company may be thought to deserve to reap some more rewards. Besides, procurement personnel may be wont to think, we already know those guys and they do a good job for us. Quality and quickness count for something; money isn't everything. So why not deal with that company instead of having to go through a long drawn out competition process? Over time, the original developer may become more and more confident of its position as the sole source for maintenance, and may increase the price for its services accordingly. It may thus be difficult for the government to break away from sole source maintenances no matter what the cost.

If one adds to this set of already described structural disincentives to adequate planning for software maintenance and supportability the fact that procurement personnel are often not well trained about software, system lifecycles, or data rights, one can see that the structural problems internal to the Defense Department may be significant contributors to software maintenance problems. It takes considerable sophistication and experience with major systems and what it takes to support them to plan for system supportability. Adequate planning may be made additionally difficult because at the time a development contract is let, the software for the system will often not yet be in existence, but only in the preliminary planning stages, and supportability of the software system will likely not be easily plannable until after the system is more fully developed.

It is perhaps an obvious point that the structural problems internal to the Defense Department create opportunities in software maintenance and supportability contexts for industry to charge very large sums of money for work or rights that could have been purchased more cheaply had they been bargained for at the early phases of the contractual arrangement. It is often in the industry's interest to take advantage of these opportunities when they arise.

E. Some Recommendations About Licensing Problems Relating To Maintenance and Enhancement of Software

This article has explored various problems and concerns related to the maintenance and enhancement of software acquired by DoD. The need for rights to modify, and the need for access to documentation and software development tools has been discussed at some length. While the acquisition of modification rights was found not to be a major problem for DoD, serious difficulties with respect to the acquisition of, or access to technical documentation, software tools and CAD/CAM programs was discussed. Some potential solutions to these concerns have been suggested.

The primary problem areas which have been identified herein include:

1) The need for DoD to develop arrangements whereby companies will allow it access to commercially valuable software development tools and technical documentation the contractor would not be willing to give up physical possession of, and

2) The need for DoD planning and procurement personnel to be aware of DoD's maintenance and enhancement needs as they relate to software development tools and to be alert to strengths in DoD's bargaining position in this regard prior to the actual awarding of a contract.

The following set of specific recommendations are offered for consideration as possible solutions to the maintenance and enhancement problems discussed in this article.

1. Getting Adequate Documentation and/or Software Development Tools

(a) Consider entering into escrow agreements whereby documentation is placed in the hands of a third party with the documentation to be released for use by the government only upon the meeting of certain specified conditions as another possible alternative to deal with maintenance and enhancement problems.

(b) Develop a better, more specific, more standardized set of specifications about what documentation must be delivered to DoD and with what rights.

(c) Decide upfront what arrangements the government wants or needs to make about who should do the maintenance or enhancement work. For reasons other than merely cost, the government may need to do the maintenance in-house. How much rights and how much data the government needs from a contractor will in large measure depend on this decision.

(d) Assess the relative costs of acquiring different levels of rights and of sole source, internal or competitive maintenance over time so that cost-effective choices can be made upfront. Recognize that sometimes sole source maintenance will be cheaper than acquiring all the rights and data needed to do the maintenance.

(e) Insist that procurement personnel involve both the using command and the maintaining

command in the supportability planning, perhaps even getting engineers from these latter commands to sign off on the system.

(f) Train procurement personnel about software life cycle needs, about data rights, and about software documentation as regards supportability needs.

2. Getting Sufficient Rights To Enable Competition For Maintenance

(a) Recognize that it may be difficult to impossible to compete maintenance and enhancement of software held as a trade secret by its owner. Assess, to the extent you can, what the long term maintenance needs and costs are likely to be, taking into account what cost savings may be achievable by competition. Remember that it may not be worthwhile to buy rights to compete maintenance.

(b) Recognize that DoD's only chance to get competition as to software maintenance may be when it is initially negotiating the system development contract.

(c) If DoD decides to try to compete the maintenance, it should recognize that it will need to get upfront:

(i) the ability to sublicense the software modification right or a commitment by the contractor to license another company;

(ii) the ability to sublicense its rights in documentation about the software or a commitment by the contractor to license the other company's access to the documentation;

(iii) very detailed documentation; and possibly

(iv) rights in the software tools, or a commitment from the developing firm to license a competitor's access to the tools.

(d) It may be desirable for DoD to develop a standard competitive or maintenance license provision and clause for the DoD FAR SUPP in order to alert contract officers to the need for and the appropriate manner of obtaining rights for these purposes. It seems unwise to rely on the existing definition of "license rights" to achieve this because it refers only to licensing for governmental purposes and begs the question whether competitive maintenance and enhancement are within the scope of the "governmental purpose" language.

(e) To be able to maximize the possibility of gaining agreement for competitive maintenance of proprietary software, DoD should be prepared to make arrangements :

(i) either to name who will be the third party maintainer or define what process will be used to qualify a potential third party maintainer; and

(ii) to promise the developer of the software to put the competitive maintainer under a specific set of restrictions (such as those under which the government operates as to that software).

The government might also want to consider naming the original software developer as a third party beneficiary of the agreement between the government and the third party maintainer as to restrictions on rights so that if there is abuse, the developer can directly sue the maintainer.

Notes

[1]See DoD FAR SUPP sec. 52.227-7013(b)(3).

[2]See G.L. Christian and Assoc. v. United States, 160 Ct. Cl. 1 (1963) in which the court read a "termination for the convenience of the government" clause into a military housing contract.

[3]See 17 U.S.C. sec. 106(2).

[4]See Midway Mfg. Co. v. Strohon, 564 F. Supp. 741 (N.D.Ill. 1983).

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BOTH THE DOD AND INDUSTRY HAVE SIGNIFICANT CONCERNS REGARDING MAINTENANCE AND ENHANCEMENT OF SOFTWARE. THE DOD WANTS TO BE CERTAIN IT WILL BE ABLE TO MAINTAIN AND ENHANCE SOFTWARE, AND WHERE COST EFFECTIVE, TO COMPETE MAINTENCE OF SOFTWARE. INDUSTRY WANTS ENSURE THAT ITS PROPRIETARY INTERESTS WILL BE ADEQUATELY PROTECTED. THIS PAPER WILL EXPLORE POSSIBLE WAYS IN WHICH BOTH GROUPS' INTERESTS MIGHT BE SATISFIED.

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